

### REMARKS

All claims are pending, of which Claims 1, 19, 24, and 36-40 are independent. The Applicants note with appreciation that Claims 19-23, 37, and 39 have been allowed. The remaining Claims 1-18 and 24-36, 38, and 40 were rejected under 35 U.S.C. § 103 based on U.S. Patent No. 5,943,677 to Hicks et al., in view of U.S. Patent No. 6,493,718 to Petculescu et al. and U.S. Patent No. 5,404,510 to Smith et al. The rejections are traversed. Claims 41-59 are added to the application by the present amendment. For the reasons stated below, it is believed that the claims are now in condition for allowance.

#### Rejection under 35 U.S.C. § 103(a)

Claims 1-18 and 24-36, 38, and 40 were rejected under 35 U.S.C. § 103 based on Hicks, in view of Petculescu and Smith. The rejections are traversed.

The claimed invention generally relates to optimizing data storage and retrieval in a multidimensional database system. A dimension in the database includes a hierarchy of attributes. The attributes are attributed data values. The data values are stored on a storage medium based on the data values indicated by the hierarchy so that associated data values are retrievable by a single retrieval operation. This can be particularly useful in a data retrieval operation, such as in an aggregation operation. For example, the data value used to compute the same aggregate value may be stored near each other so they can be retrieved by a single fetch operation.

With the prior art multidimensional database techniques, retrieving data values that are associated can be time consuming. Often, related data values are not stored in the same area of the storage medium. A data value retrieval operation, for example, often has to iterate through many associated data values. Multiple and often redundant fetches may need to be performed to retrieve associated values. These additional retrievals increase the time and resources required to

complete the data retrieval operation. In a large multidimensional database, such increases can be substantial.

In the claimed method of storing data values, a hierarchy of attributes in one or more dimensions of a multidimensional database is identified and stored based on data values indicated by the hierarchy. Because the invention stores data based on values indicated by the hierarchy, the claimed method can optimize retrieval of associated data values. In particular, associated data values are stored based on the data values indicated by the hierarchy so they are retrievable by a single fetch operation.

By way of comparison, Hicks relates to sparsity management for multidimensional database systems. According the Examiner at pg. 4 of the Office Action, Hicks at col. 1, ll. 23-30 discusses the claimed attributing a plurality of data values to each of the attributes and storing the data values on a storage medium based on the data values. Hicks, however, does not discuss the claimed storing data based on the data values. In fact, Hicks does not relate to the claimed technique for storing data.

Petculescu was cited in the Office Action to show the claimed concept of hierarchies.<sup>1</sup> Petculescu relates to an algorithm that determines which hierarchies to retrieve. More particularly, Petculescu discusses using a cost-benefit analysis to determine which sub-hierarchies should be retrieved and cached to satisfy subsequent queries.<sup>2</sup> Although Petculescu discusses hierarchies, it does not relate to techniques for storing data values attributed to attributes in the hierarchies. Thus, Petculescu does not relate to the claimed *attributing a*

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<sup>1</sup> See Office Action pg. 4, citing Petculescu col. 2, ll. 55-64; col. 7, ll. 9- 19.

<sup>2</sup> See Petscula, col. 2, ll. 57-64 (“The client analyzes the costs and benefits of retrieving each member sub-hierarchies from the multidimensional database of the database server and selects one of the member sub-hierarchies for each dimension as a function of the analysis. Finally, the database client retrieves the selected member sub-hierarchies from the multidimensional database.”)

*plurality of values to each of the attributes in the hierarchy, and storing the data values based on data values indicated by the hierarchy, as in Claims 1, 24, 36, 38, and 40.*

Smith was cited in the Office Action to show the claimed concept of “a single fetch.”<sup>3</sup> Smith, however, does not relate to multidimensional database systems and, therefore, Smith is nonanalogous art. Furthermore, the discussion in Smith about a single fetch is taken out of context. As discussed at col. 10, ll. 61-68, for example, Smith discusses that when a table has a number of elements below a certain threshold, the “whole table” may be retrieved with a single fetch. Smith’s single fetch discussion does not relate to the claimed technique for storing associated values so that they are retrievable by a single fetch. Rather, Smith discusses retrieving data by a single fetch when it is practical to do so. This does not relate to the claimed technique that stores data in such a way so that it is retrievable by a single fetch.

Accordingly, Hicks, Petculescu, or Smith, taken alone or in combination, does not discuss the requirements of the claimed invention, namely:

- identifying a hierarchy of attributes within at least one of the dimensions, as discussed in Claims 1, 24, 36, 38, and 40;
- attributing a plurality of data values to each of the attributes, as discussed in Claims 1, 24, 36, 38, and 40; and
- storing the data values on a storage medium based on the data values indicated by the hierarchy, such that associated data values are retrievable by a single fetch operation, as discussed in Claims 1, 24, 36, 38, and 40.

As such, the references do not address the issues associated with fetching data values in a multidimensional database system nor the solutions presented in the claimed invention.

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<sup>3</sup> See Office Action pg. 4, citing Smith col. 10, ll. 61-68; col. 15, ll. 65- col. 16, ll. 2.

Moreover, dependent Claims 3-18 require that the data values include aggregate values. As such, the data values are stored based on, among other things, the aggregate values. None of the references relate to storing data values based on aggregate values. In fact, the references do not discuss storing and retrieving data for aggregation operations. Thus, none of the references discuss the requirements of dependent Claims 3-18.

Addressing dependent Claims 7 and 8, the association is between an aggregate value and at least one data value. By storing data based on the data values indicated by an hierarchy, which is indicative of an association between a value and an aggregate value, data values associated with an aggregate value may be retrieved in a single fetch operation. Thus, storage and retrieval operations during aggregation calculations can be optimized, by storing values associated with an aggregate value so that they are retrievable by a single fetch. None of the references discuss this inventive concept. Furthermore, Claim 8 requires that the association be a parent-child relationship between an aggregate value and a child data value. None of the references discuss such a relationship between aggregate values and data values. Thus, the references do not meet the limitations of Claims 7 and 8.

Addressing dependent Claims 9 and 10, each of the data values associated with an aggregate value are stored proximate or adjacent to the other data values associated with the same aggregate value as indicated by the hierarchy so that associated values can be obtained by a single fetch. By way of comparison, none of the cited references, taken alone or in combination, discuss storing data values so that values associated with the same aggregate value can be obtained by a single fetch. Thus, the references do not meet the limitations of Claims 9 and 10.

Accordingly, the Applicants respectfully request that the rejection of Claims 1, 24, 36, 38, and 40, and their respective dependent claims be withdrawn.

New Claims

Claims 41-59 are being added to the application to claim the invention more distinctly. These claims correspond to originally filed dependent claims. Thus, no new matter is introduced by these amendments. Acceptance is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

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